EFFECTS OF MARKET PRICES AND SILVICULTURAL PRACTICES ON LUMBER VALUE OF STANDING TREES IN UNEVEN-AGED PLOTS

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ABSTRACT.—Uneven-aged management plots were established using three variables (site index, basal area, and maximum diameter). This study looked at the significance of the variables on the lumber volume per acre, lumber value per thousand board feet (Mbf), and stand value per acre as well as the influence on these analysis by market prices (May 1997, May 1998, and October 1998). The results of analyzing lumber volume indicate all three independent variables were significant. With lumber value per Mbf, only maximum diameter was consistently significant while site index was close - only significant for the May 1997 market prices. In analyzing stand value per acre, all three variables proved to be significant.

To some people, the perception of sustainability is a constant cover of trees on the land. A good way to keep trees on the land and still harvest them is uneven-aged management with single tree selection resulting in a reversed J-shaped stand structure. This stand structure provides a diversity of tree sizes and canopy heights, which results in an improved wildlife habitat and viewscape. Many private non-industrial landowners want fairly large trees on their property. Even-aged management with short rotations (25 to 30 years) does not meet these non-monetary objectives.

Private non-industrial landowners are under pressure from two directions. Environmental groups want larger trees, more biodiversity, and wildlife habitat while many industrial procurement personnel are pushing for short rotation smaller logs. An informal survey of procurement personnel from the largest companies in southern Arkansas and northern Louisiana was conducted. Three-fourths of those contacted stated that they wanted logs smaller than 18 inches because of the new equipment installed in their mills. Most new mills are designed to process smaller logs, at higher speeds, so as to handle all of the material that will be coming from the many plantations that are reaching the end of their rotations. Many procurement personnel also stated that they would not bid on a timber sale if it contained too many large trees. The other one-fourth of those contacted stated that they were still interested in purchasing large trees. Although many landowners are more interested in managing their timber resource for non-monetary objectives, they do want to be able to sell their trees and have some income from the land.

Uneven-aged management is an alternative to even-aged (plantations) and natural stands. The USDA Forest Service Southern Research Station personnel at Monticello, AR, are using 81 half-acre plots to determine the effects of three variables with three values of each and three repetitions of each combination on uneven-aged managed timber stands (Murphy and Shelton 1994). The study reported here looked at only 24 of those plots. Areas with site index of less than 81 or greater than 91 feet on a 50-year basis were selected. Also, basal areas after thinning of 60 and 80 square feet per acre were used as well as maximum diameters at breast height (dbh) remaining of 16 and 20 inches.

OBJECTIVES

The objectives of this study were twofold. The first objective was to determine the effects of the study variables on the volume and value of the lumber in the standing trees. The second objective was to determine how the current trend in market prices affect the value of the lumber. The study was a non-destructive study in that none of the trees were cut.

PROCEDURES

The study consisted of three variables, two values for each, and three replications. The resulting 24 plots, located in southern Arkansas and northern Louisiana, were cruised during the first 4 months of 1998, approximately 15 years after the start of the initial study. At each plot, normal cruise data, such as dbh and total height, were recorded for each tree with a dbh of 5 inches or more. Trees with a dbh of 9 inches or more were graded by new grading rules for southern pine trees in a natural stand by Clark and McAlister (1998). Trees with a dbh of less than 5 inches were not considered in the study, and trees with a dbh between 5 and 9 inches were considered pulpwood.

The age of each tree was needed for later calculations. To estimate the age of each tree, the dbh minus bark thick-

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ness (Farrar and Murphy 1988) was divided by the average growth rate of the plot. The average growth rate of the plot was estimated by boring three or four trees in the plot and averaging the growth rate for the last 3 inches of growth of each tree bored.

Clark and McAlister (1998) included equations for predicting the volume of lumber that would be recovered at the sawmill for each tree grade. This study used the equations relating lumber volume to dbh and total height. There are also equations for predicting what proportion of the lumber for each tree grade would be No. 1 or better, No. 2, and No. 3 or less. This study used the equations relating dbh, total height, and age.

Historically, the value of a piece of lumber was related to its width as well as its grade. To convert the lumber volumes estimated by the equations to dollar value, an estimate of the proportion of each width would have to be determined for each lumber grade and tree size. Data from an unpublished study[2] of 50 trees (10 trees of each of five dbh classes) were used to create a composite lumber price for each lumber grade and tree dbh class.

The final information needed was the actual market price of the lumber. Three issues of Random Lengths[3] were used to provide this information (table 1). The May 9, 1997 prices showed the typical price relationships with the wider lumber having a substantial premium over the narrow widths. The market report for May 15, showed the current drop in lumber prices and the fact that 2 X 10 lumber had lost its premium. The October 9, 1998 market report showed that the prices for narrower widths had stabilized while 2 X 12 lumber had lost its premium. The fall 1998 lumber prices were basically the same for all widths for a given grade. The market prices were combined with the composite prices mentioned previously to provide three sets of values (table 2) that were applied to the volumes of lumber developed from the grade equations for each tree in the study.

For each plot, the total lumber values per tree were summed. Also, for total plot value, the pulpwood values were added to the lumber values. The weight of each pulpwood tree was determined by equation (Saucier *et al.* 1981) and was multiplied by the 2-year average pulpwood stumpage price—$7.37[4].

Table 1.—*Market prices for southern pine lumber in dollars per Mbf (source: Random Lengths)*

Lumber size	Lumber grade		
	No. 1	No. 2	No. 3
		May 1997	
2 X 4	575	540	375
2 X 6	545	525	375
2 X 8	570	555	370
2 X 10	610	590	330
2 X 12	685	665	395
		May 1998	
2 X 4	495	430	322
2 X 6	492	430	307
2 X 8	485	423	300
2 X 10	460	415	300
2 X 12	500	480	388
		October 1998	
2 X 4	510	457	313
2 X 6	473	405	240
2 X 8	410	380	220
2 X 10	472	445	225
2 X 12	455	445	276

Three dependent variables were used to determine the effects of the independent variables: (1) thousand board feet per acre—Mbf/acre, (2) dollar value per Mbf—$/Mbf, and (3) total stand value—$/acre. Since Mbf/acre is independent of market price, analysis of variance ($p = 0.05$) was performed on only seven combinations of dependent variable and market price.

RESULTS

The results of the analysis indicate that all three independent variables (site index, basal area, and maximum diameter) were significant variables for lumber volume per acre. The average values ranged from 9.3 Mbf/acre for poor sites, 60 square feet basal area, and 16-inch maximum diameter, to 21.1 Mbf/acre for good sites, 80 square feet basal area, and 20-inch maximum diameter (table 3).

The average value of the lumber in dollars per Mbf for all combinations of independent variables changed from $565/Mbf with the May 1997 market prices to $444/Mbf with the May 1998 market prices to finally $411/Mbf with the October 1998 prices. The ranges of values were $533/Mbf - $584/Mbf for May 1997 to $431/Mbf - $453/Mbf for May 1998 to $397/Mbf - $420/Mbf for October 1998

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[3]*Random Lengths, Lumber Market Report, Random Lengths Publications, P.O. Box 867, Eugene, OR 97440-0867.*

[4]*Timber Mart-South, Daniel B. Warnell School of Forest Resources, University of Georgia, Athens, GA 30602-2151.*

Table 2.—*Composite prices for assigning value in dollars per Mbf to lumber grades by tree dbh*

Tree dbh	Lumber grade		
	No. 1	No. 2	No. 3
		May 1997	
10 inches	557	530	366
12 inches	574	530	366
14 inches	589	549	366
16 inches	613	569	366
18 inches	670	596	366
		May 1998	
10 inches	503	428	306
12 inches	510	428	306
14 inches	476	428	306
16 inches	493	428	306
18 inches	504	441	325
		October 1998	
10 inches	466	417	251
12 inches	449	400	250
14 inches	452	397	235
16 inches	468	412	229
18 inches	466	419	245

Table 3.—*Lumber volume (Mbf) per acre by site index, basal area, and maximum diameter*

Site index	Basal area			
	60		80	
	Maximum diameter			
	16	20	16	20
< 81	9.3	10.0	13.1	14.8
> 91	15.0	16.2	19.5	21.1

(table 4). With the May 1997 prices, both maximum diameter and site index were significant variables; with the May 1998 and October 1998 prices, only maximum diameter was a significant variable.

Stand values per acre averaged $8,521/acre ($5,054 - $12,350) for May 1997 prices, $6,682/acre ($4,101 - $9,535) for May 1998 prices, and $6,189/acre ($3,783 - $8,827) for October 1998 prices (table 5). The analysis indicated that all three independent variables (site index, maximum diameter, and basal area) were significant.

Table 4.—*Dollar value per Mbf by site index, basal area, and maximum diameter for each market price*

Site index	Basal area			
	60		80	
	Maximum diameter			
	16	20	16	20
		May 1997		
< 81	533	570	538	575
> 91	577	571	571	584
		May 1998		
< 81	431	444	437	453
> 91	448	447	444	451
		October 1998		
< 81	397	412	402	420
> 91	414	413	413	417

Table 5.—*Stand value per acre ($/acre) by site index, basal area, and maximum diameter for each market price*

Site index	Basal area			
	60		80	
	Maximum diameter			
	16	20	16	20
		May 1997		
< 81	5,054	5,750	7,093	8,608
> 91	8,723	9,444	11,144	12,350
		May 1998		
< 81	4,101	4,504	5,782	6,794
> 91	6,762	7,269	8,707	9,535
		October 1998		
< 81	3,783	4,183	5,327	6,310
> 91	6,259	6,733	8,073	8,827

DISCUSSION

The results reported here are about standing timber and since this is an uneven-aged management study, the timber will not be cut at once. Therefore, a private non-industrial landowner would not be receiving the monetary values discussed. Also, the values are for the lumber that would be recovered at the sawmill, and landowners would probably only receive stumpage price for their timber.

The more landowners know about their stands, the better they can conduct their affairs and negotiate timber sales that better reflect their holdings. Every 5 to 10 years, timber will have to be sold to maintain the basal area desired and the reversed J-shaped stand structure.

With the current trend in market prices, it is becoming more and more difficult for the private landowner to receive adequate compensation for growing larger trees. With more competition from wood I-beams and other engineered wood products, the price of the wider lumber may never recover their former premiums above the narrow lumber prices. An interesting point about the prices is that 2 X 10's and 2 X 12's went from a positive premium to a negative premium when compared with the same grade of 2 X 4's. In fact, in the fall of 1998, it is possible for one to buy 2 X 10 No. 3 lumber, rip it into 2 X 4's and 2 X 1's and sell the same volume of lumber but at a higher price.

The analysis of both lumber volume per acre and stand value per acre indicated that all three independent variables were significant. The differences in the lumber volumes resulting from the different variable combinations were so large that the stand values were significantly different for any market price.

In analyzing the dollar value per Mbf, basal area was never close to being significant. Site index was significant for the May 1997 prices, but its p value was over the 0.05 level for the other market prices (0.07 and 0.10). Maximum diameter was significant for all market prices. The main difference that caused the significance was between the 16-inch and 20-inch sites on the poorer sites(less than 81). The influence on lumber value per Mbf by maximum diameter is nearly non-existent on the good sites.

SUMMARY

The results of this study indicated that the variables in uneven-aged management can be manipulated to improve the timber volume and value while maintaining trees on the land and a periodic income to the landowner. If current market price and production equipment purchase trends continue, there will be very little incentive other than esthetics to grow large trees.

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